

siding, forming of salt crystals on brick and mortar, and paint failure. The damage that is less visible can be even more problematic.

Hidden within wall cavities, wet insulation loses R-value and makes the building less energy-efficient. Over time, many materials deteriorate and fail from being repeatedly saturated. Mold can form on wet surfaces, especially when there is moisture trapped in walls, floors, and ceilings. Carbon-based substances, particularly those that are cellulose- or wood-based, can allow long-dormant spores to gain a foothold. As long as the food and moisture sources are supplied under the right temperature conditions, mold colonies will continue to multiply.

Impeding heat flow

To make a building more energy-efficient and comfortable, heat flow must be impeded. While it is impossible to stop the different modes of heat transfer, placing obstacles in their path significantly slows them; this is referred to as 'breaking the thermal bridge.'

The bridge is the path offering smooth travel for heat transfer in poorly insulated buildings, usually made from concrete and metal with insufficient heat flow resistance between the outside and exterior walls. The best way to slow down heat transfer is to put insulation—whether in the cavity or as sheathing—between the conductor materials.

There are various products that can be used for cavity insulation, including:

- fiberglass;
- mineral wool;
- cellulose;
- open- and closed-cell foam plastics;
- reflective insulation; and
- radiant barriers.

Sheathing is usually made from:

- expanded polystyrene (EPS);
- extruded polystyrene (XPS);
- polyisocyanurate (polyiso); or
- fiberglass board.

Before selecting insulation materials, it is best to check the ratings of their thermal properties.

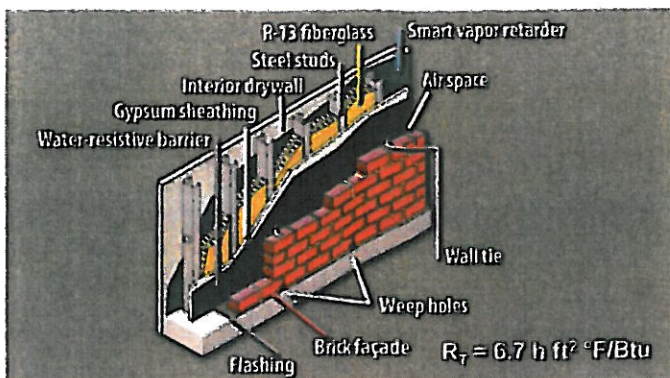
Rating insulation thermal properties

Insulation materials and building envelope systems are characterized by their individual resistances to heat flow. Material performance can be rated according to thermal conductivity (k), conductance (C), and resistance (R-value). In the case of system performance,

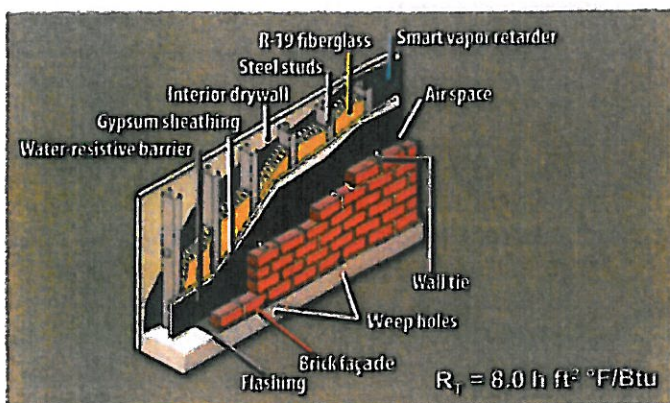
CONTRASTING THERMAL DESIGN OF THREE WALL ASSEMBLIES

This trio of images provides a snapshot comparison of the insulating values of three wall configurations.

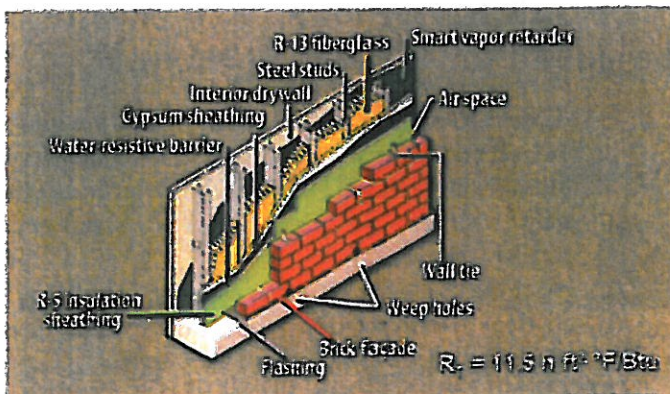
CS



This base wall assembly features a 90-mm (3.5-in.) steel stud cavity insulated with R-13 fiberglass insulation and exterior gypsum board sheathing, along with optimal air and moisture management. This assembly's total thermal resistance (R_t) is 6.7.



The above image shows the same base wall assembly, but with an increased cavity depth of 140 mm (5.5 in.) and R-19 fiberglass insulation. This improves the R_t from 6.7 to 8.0. Since the metal studs are very thermally conductive (i.e. allowing more heat flow through wall assemblies), this configuration does not achieve the insulating potential of the additional cavity depth.



The configuration shown above is thermally the best of the three. This 90-mm wall utilizes R-13 fiberglass insulation and R-5 insulating sheathing to post an R_t of 11.5.